> "BBN"
> Frank Heart Interview
> August 22, 1994/Tape Number 20
> **-- CARIBINER GROUP**

(TONE)

(OFF MIKE)

QUESTION

Okay, um, Frank, uh, why don't we start, uh, have you tell me who you are, your name and what your function was back in the late sixties.

FRANK HEART

Okay. Well, uh, my name is Frank Heart and, uh, I, uh, came to BBN in, uh, late 1966, uh, to, uh, help rescue a ... a somewhat in-trouble project and, uh, was there for a couple years, uh, before I, uh, first heard about the possibility of the ARPANET.

(OFF MIKE)

QUESTION

When you first heard about the ARPANET, and

the ARPA project that they've ... when ... what

... what were you thinking?

FRANK HEART

Well, I mean, I didn't think a lot about it right at

the beginning. Uh, it was a sunny, bright day on

the Boardwalk at Atlantic City and, uh, I was at,

uh, the Spring Joint Computer Conference. This

is a ... you know, the kind of place that lots of

people go to learn about what's going on and

mostly to meet their friends. And I was walking

the Boardwalk and talked to Larry Roberts. And,

uh, he mentioned that Arthur was considering,

uh, building a network, uh, and that there was

going to later that year be an RFP. This was in

the spring of, uh, of '68. And, uh, I was

interested in that and asked him a few questions

and then he disappeared. And that was my first,

uh, you know, knowledge at all about the

possibility of the network. I had not been

working with ARPA at all up till that time.

QUESTION

When you started finding out about what they

wanted to do and why they wanted to do it ...

can you reflect on ... on what your thinking was

at that time?

FRANK HEART

Well, I think that, uh, ARPA was hoping to be

able to interconnect some of the research centers

that it was already supporting. They were

putting up a lot of money for people to have

computers at various universities. And the idea

of a network was that people at one university

could take advantage of work that was being

done at others, and that, uh, the people could

share resources and, uh, I think they may have

had the idea that they could save some money

by letting people at have-not universities, uh,

make use of machines that existed at have

universities. Uh, I don't think that was perhaps

the major idea, but it was one of the thoughts

that went to them. But I don't think at that point
I did have very much knowledge about what it
was for. I don't think anybody, uh, had much
knowledge about what it was for. It was an
experiment. ARPA was in the business of, uh,
doing high risk, uh, experiments in computer
science and this was, uh, this was another
experiment that ARPA was considering
attempting. I don't think, uh, people at least at
that stage thought about it at all as to what it
might really be for in the longer run.

QUESTION

Uh, when you read the, uh, the specs, did you
think it was possible? Did you think it would be
important? Did you think this was a hairbrained
scheme? I mean, what were your thoughts?

FRANK HEART

Well, I think that, uh, BBN, once it heard about
the possibility of the network, you know, began
to try to think about it in advance of receiving

the actual request for proposals. And so by the time the request for proposal arrived, uh, we were, uh, you know, uh, very, very interested in the thing and, uh, we, uh, we decided it was a great opportunity. We decided that it might be very difficult for a small company like BBN to, uh, have a chance at that. But, uh, we looked at it very hard and decided that maybe it would be possible for us to work on it. We were very fortunate. We had a set of people that had had a great deal of experience from, uh, their days at Lincoln Laboratory in connecting, uh, computers to phone lines, and computers to radar sets, and computers to seismic arrays and so we had an unusually, uh, knowledgeable group, i.e., might connect computers to phones. That made us feel we had a shot at the thing. And that was part of the reason we decided it was worth the money to the company to, uh, to invest in writing our proposal. BBN was pretty small at

that point and so it was a non-trivial choice to go

spend money on a big proposal, uh, of that kind.

But, uh, we at that time didn't, uh, really think a

great deal about what the long term benefits

might be. It was simply an interesting

opportunity and a fascinating sounding project,

and, uh, obviously it would involve BBN in the

mainstream of academic computer science. And

BBN was a half-world anyway. I mean, it was a

... you know, a ... a ... a bike ride from Harvard

and a bus ride from MIT. And so it had a lot of

people that were interested in, uh, in ... in

academic computer science. It, uh, the

company, I guess, was, uh, in the business of

thinking it ought to make money, but it was, uh,

it was very much of a half-world. So I think the

people there were fascinated by the prospect of

getting more involved with all the universities in

the country and working on this network project.

(OFF MIKE)

QUESTION

Um, when you realized you got this project, um,

what were your thoughts then? (Overlap)

FRANK HEART

Well, now you're talking five or six months later

when we won?

QUESTION

Yeah, and ... and also, why do you think you did

win? Uh ...

FRANK HEART

Well, I don't obviously know completely why we

won, because it was a competitive procurement,

and ARPA was evaluating a number of different

proposals. I think that the reason we ... we had

a chance at winning was that we had an

unusually strong group of people who had had a

great deal of experience in connecting computers

to phone lines and computers to radars. [And so I

think ARPA probably felt we had a reasonable

shot at actually building the thing and making it

work. Uh, I think also ... there were probably also some other factors. Uh, BBN was, uh, a very much a, uh, a consulting company kind of background. So people there were kind of on their own. There wasn't very much top down executive management. I mean, once we, uh, were doing something, you were mostly left alone to do it. And, um, most of the people at BBN were really very much on their own. If they ... if they managed to get money for something they could survive. And if they didn't, there wasn't much company support for ... for the long term. So I think that maybe ARPA felt that we were small and, you know, and didn't have a lot of bureaucratic overhead and a lot of bureaucratic costs and so forth. And that was certainly true.

QUESTION

Did you think that, uh, you'd be able to pull this ... and again, try to incorporate the context of

the question ... did you think you'd be able to

pull this thing off once you actually got the job?

FRANK HEART

We were certain we could pull it off ... once we

got the job. We ... we were very confident that

we could do it. It was, uh, it was ... you know,

people at that point who were at BBN loved

intellectual challenges. I mean, there were

people that, uh, uh, lived and breathed on

intellectual challenges. In fact, that was better

than food and drink to many of them. And one

of the people there, a very innovative

programmer named Will Prouther(?), uh, the guy

that invented the world's first adventure game. I

mean, he ... he loved intricate little problems.

And ... and ... and so I think most of the people

thrived on ... on ... on that and viewed it as a ...

as a lot of fun.

QUESTION

Um, what were the guys like? I mean, give me

... give me some kind of idea what they ... I

mean were they ... nerdy? Did they go to

Woodstock? Uh, you know, the ...

FRANK HEART

Well, there was a mixed crew. When I first

arrived at BBN, uh, the group that I was working

with actually was a ... a somewhat nerdy group.

There were a number of MIT drop outs and, you

know, people ... people walked the halls in some

cases with shoes and socks. There were dogs in

the building. Uh, there were bicycles in the

building. People played musical instruments, uh,

during the day sometimes. And, uh, so there

was some of that. But the people that had come

from Lincoln had been more ... a more

professional group. And so some of those

people were ... were much more seasoned

professionals. And so it was a mixture. There

were, uh, there were people of ... of all flavors.

And there were some people like Bob Cahn(?),

who were very serious scientists. And ... and

not at all nerdy as you, uh, as one might

imagine.

QUESTION

Um, tell me more about this dogs, bikes,

musicians stuff. It probably tells a lot about the

atmosphere of the place you had to work in.

FRANK HEART

Well, BBN was simply a very relaxed place. I

think that, as I say, it had a consulting

background and, uh, people kind of ... as long as

they got their work done, and as long as they,

uh, were producing, uh, people didn't pay a lot

of attention to what they wore, or what else

they did as long as it didn't annoy too many

other people too much. Uh, so it was a relaxed

atmosphere. I think that was the way, though,

that we got much, much more than forty hours a

week out of everybody. I think that we ended

up getting sometimes twice that much out of

people, uh, at no additional cost to either us or the government. Uh, so it was ... it was a very relaxed ... it was a very academic, relaxed atmosphere. Much more like what you'd find in, uh, in a good university atmosphere than it was a commercial company even though BBN did try to make a profit. Hasn't been so incredibly successful at that over the years.

QUESTION

What specifically was your job on the ...

FRANK HEART

I was running the project. I was ... I was kind of the ... the ... the principle investigator of the contract, and in charge of getting the proposal written and then in charge of the project. And I stayed directly in charge of it for many years. Uh, after a while that changed, but I was basically running the project. I think that, uh, uh, well.

QUESTION

How ... how ... how was that all for you? How

were you ... your most wonderful life

experience? Was it the worst thing that ever

happened to you? Or ...

FRANK HEART

Well, actually, I think that, um, in retrospect, uh,

it certainly was a ... a real high point of ... of a

number of people's professional career. Not very

many people get a shot at riding a technological

rocket. I think that, um, uh, there have

obviously been in this century other people who

have had that ... that joy. I mean, the atomic

business, uh, the TV business, uh, you know,

molecular biology. But I think that the

ARPANET, uh, represents a technological rocket.

And it was a lot of fun riding a technological

rocket. So, yes. I ... we thought that was a ...

a very exciting experience. And certainly looking

back at it, it feels like a very exciting experience.

You don't get too many oppor... not too many

people who are technically trained get to be in

charge, or ride a big technological rocket. So it

was an unusually, uh, interesting experience.

QUESTION

Um, do you remember the, uh, the story of the

first IMP(?) out at UCLA? Were you there?

FRANK HEART

No, I wasn't physically there. I think that ... we

viewed the IMPs at that point as, uh, as children

to be very, very carefully tended. And, uh, you

know, we ... we air shipped that in and we ...

we went ... had ... people went down to the

airport and held its hand until it was physically

taken from the truck on to the dolly and from the

dolly on to the airplane. And they ... we were

there at the other end to watch it being unloaded

from the airplane. Because we viewed it as very

critical that it arrive in one piece. And, uh, you

know, people who carry boxes around the

country aren't necessarily notable for being so

incredibly careful. We wanted to be very sure

that they ... saw people watching, and were

therefore, extra careful. So that was a very

important thing for us ... to get it to UCLA on

time. And, uh, it probably got there somewhat

ahead of their expectations. I think that, uh, the

sites had their own problems. They were under

tremendous pressure to finish hardware and

software interfaces on their host computers, uh,

and they would have loved, in fact, to have had

some delay on our part. We, of course, were

under the gun to deliver on time because that's

what the contract said. So ... it was ... it was

for us, a race. And, uh, I think we probably

surprised people in that the machines go there.

And ... I guess the other thing was ... it was a

little unusual because we'd had the IMP running

in Cambridge with its program cycling. And then

we turned it off and it shut off softly. And when

it arrived at UCLA, all we did was put the power

plug on and press the "restart" button, and the program picked up where it took off. That was a big surprise. I think people there had expected that there would be days of getting it back on line and, you know, loading the program and so forth and so to have it simply run the minute it got rolled into the power plug was, I think, a surprise. But, no, I wasn't physically present at UCLA.

QUESTION

The, uh, tell us a little bit about, um, the ruggedization(?) of the IMP and, uh, why that was important. What you did and why it was important.

FRANK HEART

Well, we were very concerned about reliability. I think that, uh, my background at Lincoln had been working on the Whirlwind Computer and Osage(?) system. And there was a guy there who was in charge of those projects named Jay

Forrester, who was, uh, very, very concerned

about reliability. And so I carried that concern

with me. And ... as did some of the other people

that came from Lincoln. And, um, we were ...

we were therefore, anxious to do anything we

possibly could to make the machine stay

working. And, uh, that's not such an easy

problem, because if you think about it, these

were supposed to be unattended. They were

supposed to run for a long period without

anybody touching them. They were supposed to

run in far away places where we couldn't get at

them very easily. So we actually, uh, used

ruggedized, uh, hardware was not really mill

spec, but it was very close to mill spec. And we

paid a penalty of perhaps ten percent in the

hardware to do that. And then we put a lot of

energy into, uh, various things to allow us to

remotely figure out how the little devil was

feeling. I mean, we ... we were able to remotely

de-bug the program from Cambridge even though

the machine was sitting in UCLA. And we were

able to make it cross-patch ... that is connect

back its interfaces to itself so it could run

experiments. And we could do that remotely.

And we could load a new program remotely from

Cambridge. So when we found that we had to

change something, we could do that. And the

machine had a thing called the watch-dog timer

which meant the program, when it was operating

correctly, every little while would poke a piece of

hardware and if the little piece of hardware didn't

get poked periodically, it would restart the whole

machine. And that was a way of avoiding the

program getting into loops and just hanging up

and not doing anything. So a great deal of effort

was put into that and ... and it turns out you

can't put too much in. It's really hard to put too

much effort into reliability and fault isolation, uh,

with distributed things and distributed networks.

And so over the project's history, uh, we
continued to put a great deal of energy into ways
of trying to make the, uh, the system more
reliable and more trouble free. When you think
about a network, um, someone's sitting at a
terminal somewhere punching on their key. And
their little tremeral's(?) connected to a phone line
which is connected to a computer. That
computer is connected now to an IMP and that
IMP is connected to other IMPs and eventually to
... after a whole bunch of IMPs, it's connected to
some other host, and its program in that host ...
and when the guy punches the key, he wants it
to work. He doesn't care where in that whole
system it's broken. And so, uh, you need to
have a way when it's not working ... he calls up
and screams at you that the network is broken ...
it could be fifty different things that have gone
wrong in that long chain. And so you have to
have techniques ... we felt we had to have

techniques for being able to isolate what was wrong. I mean, should one send a Honeywell repairline ... man? Should one call the phone company? Should one call the guy at the host computer and tell him his host computer is broken? Uh, is it a modem? I mean, it's a very hard problem to isolate troubles. And so we put all kinds of things in to ... to do that.

QUESTION

Um, tell us the story of, uh, how you would, uh, you could see that the phone lines were in trouble, and you'd call the phone company to tell them that your ... they what?

FRANK HEART

Well, we ... we were ... we had some interesting experiences in trying to make the system reliable because ... for example, if there was a phone line from UCLA to Utah, uh, we had an IMP sitting on both ends of that phone line that was able to tell whether the phone line was working because

we would send test messages periodically, and if

they started not to work, we could tell in

Cambridge that the phone line was broken. Well,

in the early days of the ARPA network, when we

would call some phone company trouble office in

California, and say, "Oh, by the way, your line

from Utah to ... to UCLA is broken." They say,

"Well, where are you?" We said, "Oh, we're in

Cambridge, Mass." And they thought we were

nuts. And they ... they didn't ... they didn't

believe this at all. It took quite a while for them

to get used to the fact that we could trouble

shoot their phone lines from far away. And, uh,

that was humorous at first, because every time

we'd put in a new piece of the network around

the country there would be a new phone

company, uh, you know, trouble office

somewhere that would have to be educated to

the fact that we had far better debugging tools

for their lines than they did. And we could tell

much more precisely what was happening to

their phone lines than the phone company could.

They had to send people in with probes and

voltmeters and things. And we could ... we

were sitting there with a very fancy computer at

the end of that phone line and could do, you

know, could ... could isolate that trouble much

earlier.

QUESTION

Imagine what that would be like today with all

the phone companies and the regional Bells and

everything else that goes (Overlap)

FRANK HEART

Well, in fact it is like that today. And in fact, uh,

it's a big problem. I think, uh, as you know the

Internet's not really run by anybody and so, uh,

when things do go wrong, there are problems

like that and the more iso... trouble isolation

that's built into the various networks, the better.

QUESTION

Um, kind of switching gears for ... for a second.

Thinking ... it's twenty-five years later ... you

see what's happened with Internet. Thinking

back to that time did you have ... when you

started on this thing was it just another project?

Did you have any idea of the impact? The

implications?

FRANK HEART

Well, I think certainly at the very beginning, uh, I

at least, did not have an image of how really big

it was going to get. I think we believed it was

important. We believed it was important to a

degree because we felt that there were in fact a

great deal ... you know, it was ... anything you

do which makes communication different

between people makes a change in the world.

So I think we felt that it was important. But I

think we had an image only of it sort of affecting

computer science departments and ... and ... and

the technical community. I don't think we at

that time had the idea it was going to change the

world. I think that, uh, by five years later, I think

it ... and especially with the amazing and

surprising growth of E-mail, I think we then

realized that it was going to change the world. I

mean, a report was written, uh, with ARPA

Funds called a completion report, in probably '76

or '77. And at that time there was a sentence in

there, uh, of the general form that, uh, that the,

uh, that the use of E-mail had become so

interesting that we felt it was going to sweep the

world. And of course, it has. And you can now,

uh, send messages to President Clinton by E-

mail. And so, uh, that probably ... that ... that is

probably defined as sweeping the world at this

point. Uh, but I don't think we knew at the very

beginning how big it would be. No.

QUESTION

Um, how did, uh, jokes ... anecdotes ... I know

this something that you don't feel particularly

strongly about wanting to ... to, uh, maybe
contribute, but is there anything ... is there any
funny little story, jokes, anecdotes, best
experiences, worst experiences ... anything that
comes to mind?

FRANK HEART

(Sighs) (Laughs)

QUESTION

Guess not.

QUESTION

(Inaudible) let me coach you a little bit.

FRANK HEART

Alright.

QUESTION

Do you remember when, uh, Sahira(?) wanted to
(Inaudible) resistance pin and you were very
worried ... you were worried that Sahira was
going to go down to Washington (Inaudible)
wearing this resistance button?

FRANK HEART

Well ... in terms of how the people on the project

interacted with the government and with the rest

of the academic community, there were

obviously a ... a whole set of different kinds of

reactions. I mean, we had some people that ...

that, you know, would refuse to ever put on

anything but sneakers. Uh, Crowler(?) would

never wear anything but sneakers. And there

were other people like Ornstein(?) who ... who

were in ... very interested in ... in saving the

world. And ... and ... and being involved in

various, uh, peace movements. And so since we

were working for the Defense Department, uh,

and since we were often interacting with fairly

uptight people around the country, uh, our group

sometimes did have funny experiences. But I

don't know that I can recall anything specific. I

think it was a constant concern when we would

go to meetings with, uh, with various DOD

people and, uh, these relatively, uh, you know,

young and relatively informal people would involve themselves with it. It was obviously a certain amount of clash of personalities. But I don't know if there were specific things that, uh, that occur to me that were funny.

QUESTION

How did you as the team leader of this deal with all of this?

FRANK HEART

I tried to protect the people I had from the outside world, and the outside world from those people ... is what I did. Yes. I was a suit and ... despite my informal attire today, I was a suit and tie type in ... in the business and I was sort of in charge of being the buffer, uh, between, uh, the outside world and that group.

QUESTION

Um, and yet another change of gears here, and we may come back and retrace some of these things, but we doing fine timewise?

(OFF MIKE)

QUESTION

Um, blue sky(?) ... and I know this is hard for engineering minds ... twenty-five years from now ... where is Internet or communications going to be?

FRANK HEART

Well, I think there are several things that are obvious, and then some others that are a little less obvious as to what the future might hold. I think that, uh, it's ... it's become, I guess, very, very clear that as soon as, uh, suitable billing systems are ... are constructed and installed ... and that's happening right now, so that's only a matter of, uh, you know, one to two years before that'll be available. In other words, right now you can use the phone system when you have an 800 or a 900 number or something to make charges on your phone. In just a little while people will put in place billing systems so

the Internet can be used to buy things. That's

happening in small ways already and it's going to

happen more ... more globally soon. So certainly

there will be a tremendous increase in

commerce. Uh, the ability to buy things from all

over the world. Uh, and ... and charge them, uh,

through your ... through your Internet. That's

one trend that I think is very, very close in. I

think another thing that's clearly going to happen

is people are going to be talking to their

machines ... uh, essentially all over the world and

all their machines. I mean, you can ... you'll want

to be talking to your ... to your VCR, you'll want

to be talking to your Internet. Uh, you'll want to

be talking to your tele... to ... to your

refrigerator. And ... and so I think the use of

speech input is ... is now very, very close. And,

uh, and I think that will affect the way people

use the Internet as well as they use everything

else in their lives. So that's a second trend that I

think is ... is fairly clear. I think a third trend is
that, uh, people are soon gonna have all kinds of
personal carriable machinery. In other words, it's
not going to be very long before everybody will
kind of be ca... well, I say not very long ... you
said twenty-five years. Within that period there
will be a great deal of ... of ... of things that
people will carry in the way of computer
equipment. Like they'll carry, uh, a pulse
monitors, and they'll carry things that ... that can
help, you know, get help in the event of a heart
attack and ... and police officers will carry things
that will tell where they are when they get shot
on a back street in New York. And ... and so
there will be a tremendous increase in person
carriable computer stuff. And that stuff will all
be hooked into the Internet. So those are three
things that I would claim are ... are ... the first is
happening now. The second'll happen, you
know, in ... in a ... in a small number of years.

And the third in a somewhat longer time.

Though, there are probably other changes that

we don't know abut that ... that will take place.

QUESTION

Today ... the first ... now looking back to the

first twenty-five years what's ... what's the

single greatest accomplishment ...

(OFF MIKE)

(CUT)

(END OF TAPE #20)